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COVER PAGE

Photo taken during the Central Council of Health Meeting held at Madras, (From Left to Right) Dr. (Mrs.) H. M. Sharma, Director of Public Health The Hon'ble Health Minister of Maharastra, Dr. Susila Nayar, Union Minister and Mrs. Jothi Venkatachalam, Health Minister Madras State.

An extract of the letter from the Director, of Public Health, Madras from the Director, Central Health Education Bureau New Delhi.

With your able direction and continued support, the State Health Education Bureau organised a very nice display at the Central Council of Health meeting which was very much appreciated by one and all. This has set an example for other States to follow. I also wish to express my deep appreciation to all officers and staff of the State Bureau who worked very hard in making this excellent display possible.

Dr. V. Ramakrishna,
Director,
Central Health Education Bureau,
New Delhi

19 MAY 1964

Kitchen Gardening

Director of Agriculture, Madras

THE pressing need of the hour is to increase Food Production. Vegetables form an important component of food. Vegetables Constitute a good Protective food, rich in minerals and vitamins, so essential for health and growth. Vegetables form an indispensable adjunct in our diet. It is stressed that an adequate balanced diet should contain 10 oz. of vegetables per day. The present level of vegetable production is inadequate to meet the normal demands of the country. The need is even greater due to the National Emergency as Vegetables provide not only balanced food but also help to relieve the strain on the food grains position. It is our primary duty and responsibility to put in all our efforts to produce more food, especially vegetables. There is a lot of scope for the intensive cultivation of vegetables in the cities and towns. Every house with a compound could easily set a part a portion of it for a kitchen garden. Laying out a vegetable garden is not difficult these days. Special departmental staff appointed for this purpose render free advice and assistance. The people of the city of Madras are lucky in this respect. A special step-up-drive is being organised in the city. Every housewife can avail of this opportunity and make her house self-sufficient regarding vegetable requirements.

A well managed kitchen garden is a source of constant supply of delicious and wholesome vegetables of one's own choice. Added to it is the advantage of adequate supply of quality table vegetables in the utmost fresh condition. Kitchen garden meets the urgent needs of the family at the required time. It provides a profitable recreation to the family and gives the pleasure of being independent of outside sources of supply of vegetables. Above all, home grown vegetables are the triumph of one's own labour.

LOCATION:

Location of a kitchen garden in the city has its limitation. Any space available may be made use of to the best advantage. Preferably, however, the kitchen garden may be located in the backyard rather than in the front. As far as possible shady situations should be avoided and open and sunny plots should be selected for growing most of the vegetables grown in the plains.

SOIL & SOIL MANAGEMENT:

Since kitchen gardening is a form of intensive cultivation, the soil requires a thorough and clean cultivation with heavy manuring. An excellent method of doing this is by dividing the plots into narrow rectangular strips of convenient size. Each strip is taken up at a time. The top soil of the first strip is removed to a depth of about a foot and kept aside. The soil beneath the dug out strip is broken up well and manured liberally. The top soil is then replaced over the manured strip. Vegetable cultivation on such strips has given good results. Farm yard manure or compost may be applied at the rate of 1 to 1½ lb. per./sq. ft. If however, the top soil is not good, red earth may be carted and spread out to improve it.

PLANNING:

Planning a garden is very essential to get the best results. The main objective of a kitchen garden is to get a continuous supply of a wide variety of vegetables all the year round. Succession cropping aims at this end. In planning, one should consider the soil, the crop seasons, the availability of space and also the choice of vegetables based on the likes and dislikes of the family.

SEEDS & SOWING

Selection of good seed is one of the essential conditions for success in vegetable growing. Purity, quality and viability of the seed should be ascertained before purchasing or sowing of seed. It is advisable to build one's own seed stock from

disease-free, heavy yielding plants. Good viability is denoted by a minimum of 80% germination. This is of prime importance (if losses and disappointment are to be avoided).

Sowing should be even, neither too thick nor too sparse. The seeds may be sown either broadcast or in lines, covered up either by raking the soil over or if the seeds are very small by sifting a little soil over the rows. On light soils it is generally good to firm the soil by pressing it with the back of a spade.

Watering should be done with utmost care, preferably with a can fitted with a fine rose so that the water may be distributed evenly without dislodging the seeds.

Over crowding of seedlings and excessive moisture resul in poor drainage and encourage diseases which cause severe damage.

NURSERY BED FARMING:

In the case of many vegetables like brinjals, tomatoes, chillies, cabbage, cauliflower etc. the seeds have to be sown in specially prepared seed-beds and the seedlings transplanted in the final site later on.

The site for locating these 'Nursery beds' should be fertile or should be heavily manured and located close to the water source, away from large trees and in a sunny situation. The conditions for good growth can be provided by hoeing, raking and harrowing and then bringing the soil to fine powdery condition.

Heavy manuring should be done for the nursery bed. 100 cart loads of compost or Farm Yard Manure, that is one cart load of manure per cent may be applied.

The beds should be raised by about 3 inches and of 8 feet breadth. The length may be upto 54 feet (so as to have a cent nursery).

TRANSPLANTING :

Before transplanting the beds should be irrigated a day prior to the removal of seedlings to facilitate easy lifting without damage to the roots. Once out of bed, the seedlings should be kept in water or shade until they can be transplanted.

In case of larger seedlings as in cabbages and cauliflowers, where it may not be possible to lift the seedlings without injury to roots, the leaves may be shortened. Only vigorous and healthy seedlings should be selected for transplanting, discarding the ill-developed ones.

CULTIVATION :

It is advisable to prepare ridges and furrows three feet apart (that is three feet from ridge to ridge or from furrow to furrow) which is the usual distance for almost all crops. The seeds or the seedlings are to be transplanted about 4" away from the furrow and only on one side of the ridge.

If the seeds are to be sown in beds, they may be sown in lines.

The above two methods of cultivation will facilitate easy and proper irrigation and reduce casts in weeding and other operations.

Earthing up is done when the plants reach a height of about 12" or after a month of sowing or transplanting. Weeding should be done at regular intervals so as to keep the land clean of weeds.

FERTILIZING

In addition to 100 cart loads of compost or Farm yard manure as a basal dose per acre we have to apply generally the following fertilizers for all crops.

45 kg. of C. A. N. (Calcium Ammonium Nitrate)
90 kg. of Super phosphate and
45 kg. of Potash

Usually half the quantity of C. A. N. along with super-phosphate and potash may be applied at the first instance, a month after sowing or transplanting of vegetable crop. Then the next dose of half the quantity of CAN may be applied a month after the first dose.

The fertilizers should be covered by the soil immediately after each application.

IRRIGATION

Copious and regular irrigation has to be given for all crops, especially after the application of fertilizers But the irrigation should not be excessive.

PLANT PROTECTION

Seedlings should be dipped in Parathion (that is 1 oz. of Parathion in 12½ gallons of water) and then planted as a prophylactic measure.

But, in all cases, a month after sowing or planting, the crop may be sprayed with Parathion which will reduce the insect population.

As soon as any insect pest or disease in noticed, immediate control measure has to be taken in order to prevent further spread of pest or disease.

Always prevention is better than cure.

Plan of a model kitchen garden :

(Plans Enclosed).

100 Square Feet :- Plot I

June, July — Amaranthus
August, November — Bhendi
December, February — Onion
March, June — Brinjal

Plot II

June, September — Bhendi
October, Janauary — Brinjal
February, Marce — Amaranthus
April, May — Radish

Plot III

June, September — Tomato
October, December — Carrot Radish
Janauary, February — Greens
March, June — Bhendi

Plot IV

June, September — Brinjal
October, November — Greens Cabbage
December, March — Bhendi
April, June — Cowpea

600 Square Feet :– Plot I

June, July — Amaranthus
July, October — Bhendi
October, December — Carrot radish
January, March — French Beans
April, May — Radish

Plot II

June, September — Brinjal & Onion
October, January — Cabbage & radish
February, May — Bhendi

Plot III

June, Septemder —Bhendi onion
October, December — Cowpea
January, February — Knol khol
March, June — Tomato

Plot IV

June, August — Cluster Beans
September, December — Brinijal Radish
Januery, February — Greens
March, May — Bhendi

MUSTS IN A KITCHEN GARDEN

1 Use healthy, pure and good viable seeds.

2 Pull out only healthy, pest and disease free seedlings for transplanting.

3 Dip the seedlings in parathion (1 ounce in 12½ gallons of water) as a prophylactic measure.

4 When sowing very small seeds like Amaranthus, mix the seeds with D. D. T. 5% to prevent ants taking the seeds.

5 A month after sowing or transplanting spray with Parathion (1 ounce in 12½ gallons of water) as a prophylactic measure Apply fertilizer after weeding.

6 Weed a month after sowing or transplanting or when the plants reach a height of about 12" whichever is early. Earth up the crop at the time of weeding.

7 After weedig, apply fertilizer. Except calcium Ammonium Nitrate, all manures and fertilisers should be applied before sowing or transplanting. Calcium Ammonium Nitrate may be applied at monthly interval, the first dose a month after sowing or transplanting.

8 Irrigate immediately after applying fertiliser. The irrigation should be copious but not excessive.

9 Whenever you notice a pest or disease immediately consult your Extension Officer for Agriculture or Gramasevak and adopt control measures.

10 Dusting or spraying against pest or diseases should be stopped three weeks prior to the harvest of the crop.

CAUTION :

Avoid indiscriminate use of chemicals.

(a) BHC should not be used against vegatable crop as it will traint the crop.

(b) DDT should not be used against cucurbits.

CONCLUSION :

In view of the National Emergency, I appeal to one and all to raise the miximum quantity of quality vegetables in their gardens for there own requirements and to spare their suprlus for our brave Jawans in ihe front.

Dedicate your self with devotion and determination to grow miximum quantity of vegetables of quality and do your duty by the Nation.

INCREASE IN POPULATION AND ITS IMPACT ON THE ECONOMY OF THE COUNTRY

By N. V. K. K. Nambiar, M.A. DIP (Econs).,
Statistician.

THE present rate of incraese in the population of the country calls for serious consideration. It is an established fact that a high rate of population growth will result in the deterioration of living conditions and will also be a bar to the progress of the country. This is the reason why the family planning experts are well pondering over this problem. We are now in an era of planning and still the standard of living of the common man has not significantly improved. The population is increasing roughly at the rate of 2 percent per annum and the country's economy does not cope up with this growth.

Important factors in the growth of population :—

The basic facts underlying in the increasa in population are

(1) A remarkable reduction in mortality due to the vast improvement in the field of Public Health and medicine

(2) A more or less stabilised birth rate

(3) Increase in annual growth rate.

Over Population Problem of Population :

Even if it is assumed that the birth rates would decline almost equally which is not the case as the death rate and the 1951—61 growth rate is maintained the population would generally grow by some 50% in 20 years. If there is no check on fertility this addition would be greater.

Solution of the problem :

The main solution suggested by experts is the economic development of the country to keep pace with the enormous growth of population. But at the same time we have to remember that the mounting price level and the inequitable distribution of income stand in the way of economic development and further aggravates the miseries of the common man like agriculturists and labourers. The alarming rate of increase in population is becoming an increasingly grave and vital problem in India and is seriously interfering with the progress of the five year plans. In every hour more than 500 new mouths require to be fed in India. Family Planning is considered as one of the solutions for the over population problem. This is designed to prevent the Calamilies of over-population. The crux of the problem now is the recurring increase every year in the number of additional mouths to be fed against no certainty in comparative increase in food production.

Poorer countries are found to contribute more to the population growth of the world. This only indicates that the population is becoming denser in the economically backward areas, compared to developed countries. The economic gap tends to widen between the rich and the poor nations.

Protain in take & higher Standard of living

It is considered by nutrition experts that protein intake indicates higher standard of living and poverty is generally reflected in lower intake of protain. In India the daily intake of protein is found to be very low compared to Western countries.

In recent years studies in population growth have revealed that higher per capita expenditure is the best index of a higher standard of living and tends to be associated with a lower number of children. The Birth rate declines only after the living standard has reached a certain level.

Immediate Need-Food-Production

India to-day stands on the link of a great social and economic revolution. The series of Five Year Plans are only attempts to bring about this revolution. The Planning experts have begun to feel that such a revolution shall have no firm and realistic base if the rate of population growth exceeds reasonable limits. The painful thing now is that when the national income rises poverty does not tend to decrease. but only tends to increase. The per capita calorie intake and that of essential nutrients have not increased after increase in national income. The main reason for this is the increase in population.

It need hardly be emphasized that in order to provide sufficient food for all mankind, taking in to account the anticipated increase in population, it is absolutely necessary to increase food production. This is the first thing that has to attract the attention of all planning experts.

Damographic Studies are needed

It is also considered absolutely essential that prime atten. on should be paid to the development of methods of populations planning. Damographic studies also should be carried out to determine the most effective way of devising measures for population control. The propaganda regarding family planning have also to be strengthened to a great extent.

A STUDY OF 1,000 CASES OF SMALLPOX

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Introduction

It is more than 150 years that Edward Jenner gave to the world the most potent weapon against smallpox. The efficacy of vaccination as a protective measure against smallpox has been proved beyond doubt. Yet the disease could not yet be eradicated from several parts of the world. The weapon is there; but its utilisation to the utmost advantage is beset with several practical difficulties. It requires good planning, the co-operation of several sections of the community and also the co-ordination of several limbs of the administrative machinery. If certain countries have been successful in eradicating small-pox, it was not by means of mass vaccination but by keeping the infection off their shores. Infection may be imported from other countries accidentally through contacts of smallpox cases during the period of incubation (Tottenham epidemic of 1957 and Merseyside epidemic of 1958). In spite of severe precautions occur, due to quick air and sea travel connecting different countries.

Conditions in India are quite different. Infection is always present and the only way to eradicate the disease is by an intensive programme of vaccination. Several states in India are endemic for smallpox and this has been a perennial problem to solve. Already the Government's attention has been drawn to this problem and several states are launching eradication programmes.

Madras city is one of such endemic areas for smallpox. The Corporation of Madras maintains a permanent and separate hospital for isolation and treatment of infectious diseases. Under the Madras Public Health Act of 1939 and the City Municipal Act of 1919, notification of occurrence of smallpox is compulsory in the city and isolation is effected in the Hospital for Infectious Diseases. Barring a few cases that may escape detection, the admission of smallpox cases into the Infectious Diseases Hospital represents fairly accurately the general incidence of the disease in the City. In this paper we have discussed some of the salient features about the incidence of smallpox, with special reference to the various epidemiological features and the relationship of vaccination tatus of individuals to the incidence.

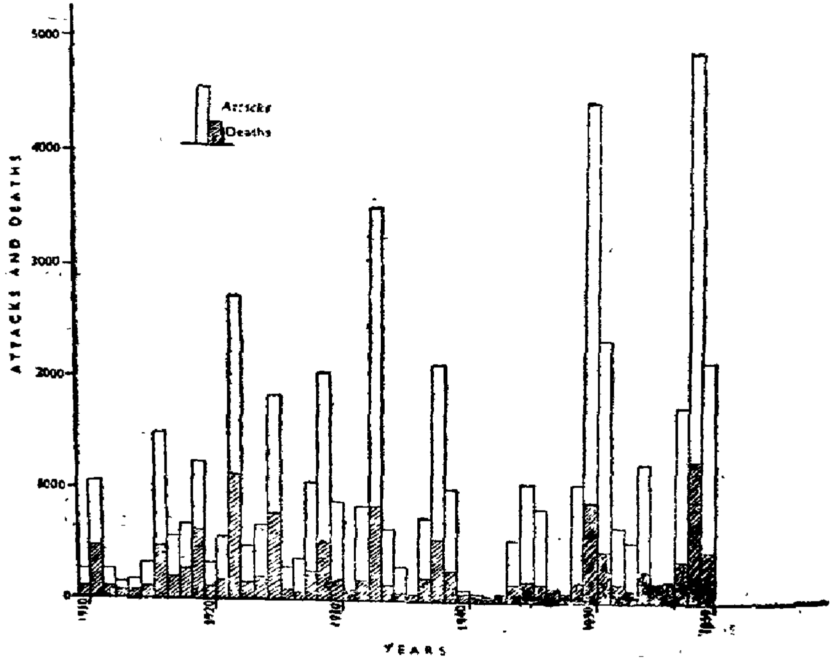

Fig. 1—Showing Distribution of Attacks and Deaths due to Smallpox in the Madras City from 1910 to 1959

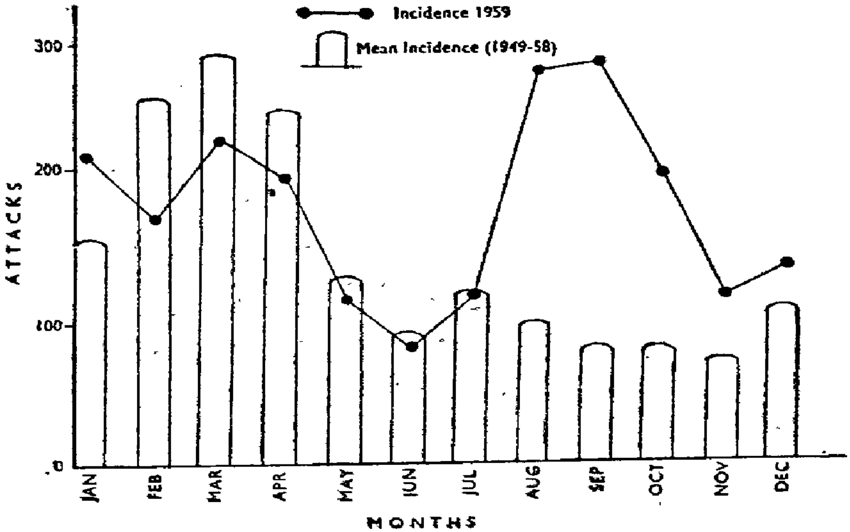

Fig. 2—Showing the Mean Monthly Incidence of Smallpox for the Period 1949-1958, Compared with the Incidence of 1959

Materials and Methods

1,000 cases of smallpox were admitted to the Infectious Diseases Hospital from various parts of the city during the period of from 1st May to 20th October, 1959. These cases were treated by the authors, and selected for study. The findings are presented in this paper under the following sections: 1. Epidemiological features. 2. Incidence by age and sex. 3. Incidence and vaccination. 4. Mortality. 5. Haemorrhagic smallpox.

Epidemiological Features

1. *Periodicity*—Statistical records for the last 50 years, show that the city of Madras has never been free from infection of smallpox in any year. Fig. 1 shows the attacks and deaths due to the disease in the city during the last 50 years. Though the infection has been prevalent every year, yet it is evident that it reached epidemic levels periodically, roughly every 4 to 6 years. It is also seen that the epidemic conditions spread over a period of 3 years, the central year being the peak year.

2. *Seasonal prevalence*—Though prevalent throughout the year, smallpox shows some seasonal variations, the highest incidence seem to occur in the months of February to April. Fig. 2 shows the mean monthly incidence for the 10-year period, 1949 to 1958, compared with the incidence of 1959. Rogers (1945) described the relationship between the incidence of smallpox in India and meteorological conditions, especially absolute humidity. Murthy *et al* (1958) discussed the relationship between the incidence and intensity of ultraviolet rays in the atmosphere. It is true that the months of February to April are dry months in Madras, though not the hottest. The incidence of 1959 showed a definite deviation from the normal trend in that; the maximum cases occurred in the months of August and September. The reason for this deviation requires explanation and whether it has any relationship with any meteorological factors, is a subject for a further study.

3. *Environmental factors*—The municipal areas having maximum number of slums and homeless pavement dwellers happen to be the foci whence this disease started. The characteristic features of such areas are : first, the residents of the slums and pavements do not have proper residential addresses with the result that the children born of women in the locality cannot easily be traced at the time of vaccination from the addresses given at the lying-in hospitals. Hence the majority of the children are disposed of as 'non-traceable' by the vaccinators and they remain unvaccinated. Secondly, these areas attract from outside the city immigrants who are invariably unvaccinated and who come for employment and settle in slums and on the pavement. Thirdly, both men and women of this class are workers who leave their homes early in the morning and return only late at night. Lastly, the size of majority of these families is large and they live in overcrowded single roomed huts. All these factors help in very rapid transmission of infection once it is implanted in the locality.

Incidence by Age and Sex

Smallpox is a disease that shows no respect for age, sex, race or community. It affects all ages and both sexes; the poor and the rich are affected alike. The only factor that may influence its incidence, is the vaccination status. The distribution according to age and sex is described below :

One variety of Smallpox, the "Haemorrhagic" has been excluded from the general analysis and dealt with separately. This variety has very little in common with the other varieties, either in the manner of distribution, or the course or prognosis of the disease. It is an entity separate by itself.

1. *Age*—The disease affected all age-groups in this series, the youngest was 13 days old and the oldest was 60 years. With about 28 per cent (274) of the total cases occurring in children below 6 years of age, and only 10 per cent (98) in the next higher age-group (6 to 10 year), the incidence rose with increasing age to about 29 per cent (285) in the age-group 21 to 30, and thereafter it gradually declined. If the age-group below 6 years is further subdivided it can be seen that there were only 2 cases in infant aged below 30 days and 54 cases in the group of 1 month to 6 months (Tables 1 and 2).

2. *Sex*—The disease was equally prevalent in both the sexes with 486 in each sex (Table 1). Though numerically the incidence is the same, yet the specific case incidence rate in females would be greater, since the proportion of females in the general population according to the 1951 census is less roughly by 8 for every 100 males.

With reference to age and sex, there was greater incidence in females in the proportion of 4: 3 in the age-group of 6 to 20 and this was compensated by greater incidence in males in the other age-groups.

Incidence Vaccination and Sex

1. *General considerations*—For this study, the presence of a scar of successful vaccination was taken as the criterion for classifying the cases into two groups, the 'unvaccinated' and the 'vaccinated'.

The unvaccinated are (a) those persons who were never vaccinated, (b) those persons who were reported to have been vaccinated but did not present any scars of successful vaccination and also (c) those who were vaccinated only during the incubation period of the present attack.

The vaccinated were those persons who bore scars of successful vaccination whether primary or re-vaccination and also included those who presented evidence of a previous attack of smallpox. In the series under review (1,000 cases) there was none who had any evidence of previous attack of smallpox. Further, barring one isolated instance, there was no case who presented scars of successful re-vaccination. Since a re-vaccination, which did not produce either a vaccinial or vaccinoid take, is not considered to be of much significance (Seal, 1959), for all practical purposes only the scars of primary vaccinations were taken into consideration.

In all, there were 430 cases among the unvaccinated as against 542 in the vaccinated. With reference to the number of scars of vaccination there were, amongst the vaccinated, 61 with one, 184 with two, 51 with three and 246 with four scars.

2. *Vaccination and age*—In the unvaccinated, the maximum incidence of 60 per cent (262) occurred in children aged 5 years and below and the incidence gradually declined with increasing age. Whereas, in the vaccinated, the incidence is the lowest in the extremes of life with 2.2 per cent (12) in the age-groups of 5 years and below and 1.6 per cent (3) in the age-group of 51 years and above and the highest about 46 per cent (248) in the age-group of 21 to 30. In infants and children below 2 there was no case in the vaccinated as against 141 in the unvaccinated. The incidence in the vaccinated is relatively less only up to the age of 10 years, and beyond that age it was more in the vaccinated than in the unvaccinated Table 3 shows the distribution of cases according to age and sex with reference to vaccination status.

Table 1—Showing Distribution of Cases according to Age and Sex

Sex	Age group (years)							Total
	0-5	6-10	11-20	21-30	31-40	41-50	51 & above	
Male	145	39	88	147	47	17	3	486
Female	129	59	114	138	28	10	8	486
Totals ...	274	98	202	285	75	27	11	972

Table 2—Showing Distribution of Cases according Age (below 6 Years) and Sex

Sex	Below 30 days	1 month to 6 months	7 months to 12 months	13 months to below 2 years	25 months to below 3 years	37 months to below 4 years	49 months to below 5 years	61 months to below 6 years	Total
Male	1	25	18	24	25	13	17	22	145
Female	1	29	20	23	19	13	11	13	129
Totals ...	2	54	38	47	44	26	28	35	274

3. *Vaccination and sex*—The distribution by sex was not affected by vaccination at all. There was exactly equal number of cases in either sex, with 215 of each sex in the unvaccinated and 271 of each sex in the vaccinated. However there was greater incidence in females in all age-groups except 0–5 years and 21-30 years in the unvaccinated whereas in the vaccinated, there was greater incidence in females up to 20 years beyond which the incidence was greater in males (Table 3).

4. *Vaccination and type of rash*—Cases of variola major were mainly of two clinical entities, viz., the haemorrhagic and the non-haemorrhagic. As stated already, the haemorrhagic variety was excluded from the general analysis and dealt with separately.

The non-haemorrhagic group was further divided into three clinical varieties depending upon the density and the evolution of the rash. The rash on the face was taken as the index to measure the density.

(a) The 'confluent' type—Cases where the rash on the face was so dense and coalescent that there was little healthy unaffected skin in between were classed as confluent. Some of the cases of this group might not have such a confluent rash on other parts of the body except the face.

(b) The 'discrete' type—This type was characterised by cases where the rash on the face was discrete leaving areas of skin unaffected in between; but the rash evolved through all the stages of the macule, papule, vesicle, pustule and scab.

(c) The 'modified' type—This class is typified by cases where the rash was discrete, but the evolution was quickened and the rash might have scabbed off even without going through all the stages.

It is believed that the severity of the rash is inversely proportional to the immunity level in the individual against smallpox.

Table 3—Showing Distribution of Cases according to Age, Sex and Vaccination Status

Age group (years)	Unvaccinated			Vaccinated			Total Cases		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
0—5	140	122	262	5	7	12	145	129	274
6—10	29	33	62	10	26	36	39	59	98
11—20	22	30	52	66	84	150	88	114	202
21—30	20	17	37	127	121	248	147	138	285
31—40	3	7	10	44	21	65	47	28	75
41—50	1	3	4	16	7	23	17	10	27
51 & above ...	0	3	3	3	5	8	3	8	11
Totals ...	215	215	430	271	271	542	486	486	972

Table 4—Showing Distribution of Smallpox in the Unvaccinated and Vaccinated in Different Age Groups

Age group (years)	Unvaccinated				Vaccinated				Total			
	Modified	Discrete	Confluent	Total	Modified	Discrete	Confluent	Total	Modified	Discrete	Confluent	Total
0—5	—	93	169	262	1	8	3	12	1	101	172	274
6—10	—	19	43	62	1	32	3	36	1	51	46	98
11—20	—	16	36	52	26	107	17	150	26	123	53	202
21—30	1	12	24	37	34	175	39	248	35	187	63	285
31—40	—	1	9	10	7	41	17	65	7	42	26	75
41—50	—	1	3	4	2	13	8	23	2	14	11	27
51 & above	—	1	2	3	—	4	4	8	—	5	6	11
Totals	1	143	286	430	71	380	91	542	72	523	377	972

In this series (1,000 cases) only 972 belonged to the non-haemorrhagic group. Irrespective of vaccination status 38.8 per cent of the total cases were of the confluent type. With reference to the vaccination status 66.5 per cent (286) of the total unvaccinated cases were confluent, as against only 16·7 per cent (91) of the total vaccinated. The ratio between the discrete (including modified) to the confluent was 1: 2 in the unvaccinated against 5: 1 in the vaccinated.

As regards the incidence of confluent cases with reference to age, in age-group of 10 years and below, nearly 65 per cent of the total were confluent in the unvaccinated as against 12·5 per cent in the vaccinated. The proportionate incidence of confluent attacks to the total increased with increasing age in the vaccinated, to nearly 45 per cent in persons of the age group of 51 years and above whereas in the unvaccinated, it was least with 54 per cent in the age group of 21 to 30 and varied from 60 to 70 per cent in other age-groups.

As regards sex, there were more confluent attacks in females in the vaccinated. This increased prevalence was mostly confined to the age-group 11 to 30 where there were 37 females against 19 males with confluent attacks. This increased incidence of confluent attacks among females was compensated by a greater number of modified cases in males. In the unvaccinated such wide disparity between the sexes was not found. Table 4 shows the distribution of cases according to clinical types with reference to age and the vaccination status.

5. *Vaccination scars and smallpox incidence*—For all practical purposes the scars of primary vaccination were taken in to consideration, since none except one, presented any scars of re-vaccination.

Unless a child was debilitated or under-aged it is the practice in the city to make four insertions for all primary vaccinations, two in each arm. The Rotary Lancet method, when applied with the correct technique, leaves a standard-sized scar. It can safely be presumed that persons with 4 primary

Table 5—Showing Age Distribution of Smallpox Cases with Reference to the Type of Rash and Number of Vaccination Scars

Age group (years)	1 scar				2 scars				3 scars				4 scars				Total			
	M	D	C	T	M	D	C	T	M	D	C	T	M	D	C	T	M	D	C	T
0—5 ...	—	2	1	3	1	4	1	6	—	1	1	2	—	1	—	1	1	8	3	12
6—10 ...	1	7	1	9	—	12	1	13	—	2	—	2	—	11	1	12	1	32	3	36
11—20 ...	4	12	—	16	7	26	7	40	4	12	—	16	11	57	10	78	26	107	17	150
21—30 ...	2	18	2	22	15	60	18	93	2	18	3	23	15	79	16	110	34	175	39	248
31—40 ...	—	3	—	3	4	10	13	27	1	2	—	3	2	26	4	32	7	41	17	65
41—50 ...	1	3	3	7	—	1	2	3	—	3	—	3	1	6	3	10	2	13	8	23
51 & above	—	1	—	1	—	—	2	2	—	1	1	2	0	2	1	3	—	4	4	8
Totals ...	8	46	7	61	27	113	44	184	7	39	5	51	29	182	35	246	71	380	91	543

M = Modified; D = Discrete; C = Confluent; T = Total.

vaccination scars will outnumber several times the persons with less scars in the general population. In a study of a sample population in Madras city in 1944 it was found that the 4-scar persons in the general population were several times more than those with lesser number of scars. The incidence of cases with reference to the number of scars in the present series was therefore not comparable unless we had the data of the distribution of scars in the general population. However, the incidence with reference to scars was 61 cases with 1, 184 with 2, 51 with 3 and 246 with 4 scars

The proportionate incidence of the confluent attacks with reference to the number of scars was : 11·5 per cent with 1, 23·9 per cent with 2, 10 per cent with 3 and 14·2 per cent with 4 scars. With reference to age, amongst cases of 10 years and below age-group only 7·7 per cent of the 4-scar group were confluent as against 7·5 per cent in the 3-scar, 10·5 per cent in the 2-scar and 16·6 per cent with the 1-scar group. But the difference between 1- and 2-scar groups and 3- and 4-scar groups was more marked, the proportionate incidence of confluent cases was 20·8 per cent in the 1- and 2-scar groups as against 13·4 per cent in 3- and 4-scar groups. Table 5 shows the distribution of cases according to age with reference to number of vaccination scars.

Mortality

1. *General consideration*—Deaths from smallpox were mostly due to septicaemia produced by secondary invading organisms and consequent complications. But in unvaccinated children, it was not uncommon to find deaths occurring without much secondary infection; this is perhaps due to the virus toxaemia. Out of 970 cases there were 171 deaths with a case fatality rate (C. F. R.) of 18·7 per cent. The most impartant factor that influenced the prognosis was vaccination.

2. *Vcacination and mortality*—Irrespective of the age groups, there were 161 deaths out of 430 unvaccinated cases, with a C. F. R. (case fatality rate) of 37·4 per cent, as against 10 deaths out of 542 vaccinated cases, with C. F. R. of 1·8 per cent.

3. *Vaccination, age and mortality*—There was no death in the vaccinated in the age group of 10 years and below. Whereas in the same age, there were 139 deaths, with C. F. R. of 42·9 per cent in the unvaccinated. The C. F. R. was the least (19 per cent) in the age group of 21 to 30 in the unvaccinated, whereas it was the least (1.3 per cent) in the age group of 11 to 20 in the vaccinated. All the fatalities in the vaccinated occurred in age-groups of 11 to 40, whereas in the unvaccinated the deaths were maximum in the extremes of life and minimum in the age-group of 21 to 30. Fig. 3 shows distribution of cases and deaths according to age with reference to vaccination status.

4. *Vaccination, sex and mortality*—There was greater mortality in males than in females in the unvaccinated with 85 and 76 deaths respectively, whereas in the vaccinated it was just the reverse, the figures being 3 and 7 respectively in males and females. Table 6 shows the number of cases, deaths and C. F. R. with reference to age, sex and the vaccination status.

5. *Vaccination, type of rash and mortality*—The C. F. R. for the discrete and the confluent varieties in the unvaccinated were 9 per cent and 51·7 per cent respectively as against 0·26 per cent and 9·9 per cent in the vaccinated. In the age-group of 10 years and below, there was no death in the vaccinated whereas the C. F. R. for the confluent type was 60 per cent in the unvaccinated. With reference to sex the C. F. R. was higher for the confluent in females in the vaccinated, the figures being 5·1 per cent and and 13·4 per cent respectively for males and females as against 54·5 per cent and 48·9 per cent respectively in the unvaccinated. Table 7 shows the number of cases, deaths and C. F. R. with reference to vaccination status and the type of rash.

6. *Vaccination scars and mortality*—The C. F. R. of different scar groups was nil in 1-, 3·7 per cent in 2-, 2 per cent in 3- and 0 8 per cent in the 4-scar groups. Similarly the C. F. R. for confluent attacks in the different scar groups was nil in 1-, 16 per cent in 2-, nil in 3- and 5·6 per cent in 4-scar groups. Table 8 shows the number of cases, deaths and C F.R. with reference to type of rash and the number of vaccination scars.

Table 6—Showing Distribution and Number of Cases, Deaths and C. F. R. with Reference to Age, Sex and Vaccination Status

Age group (years)	Unvaccinated									Vaccinated									Total		
	Males			Females			Total			Males			Females			Total					
	C No.	D No.	CFR %	C No.	D No.	CFR %	C No.	D No.	CFR %	C No.	D No.	CFR %	C No.	D No.	CFR %	C No.	D No.	CFR %	C No.	D No.	CFR %
0—5 ..	140	63	45	122	54	44.2	262	117	44.6	5	—	—	7	—	—	12	—	—	274	117	42.7
6—10 ...	29	14	44.4	33	8	24.2	62	22	35	10	—	—	26	—	—	36	—	—	98	22	22.4
11—20 ..	22	2	9.0	30	9	30.0	52	11	21	66	—	—	84	2	2.3	150	2	1.3	202	13	6.4
21—30 ...	20	6	30	17	1	6	37	7	19	127	2	1.5	121	3	2.4	248	5	2.0	285	12	4.2
31—40 ...	3	—	—	7	2	28	10	2	20	44	1	2.2	21	2	9.5	65	3	4.6	75	5	6.6
41—50 ...	1	—	—	3	1	33.3	4	1	25	16	—	—	7	—	—	23	—	—	27	1	3.7
50 & above	—	—	—	3	1	33.3	3	1	33.3	3	—	—	5	—	—	8	—	—	11	1	9.1
Totals ...	215	85	39.5	215	76	35.5	430	161	37.4	271	3	1.1	271	7	2.5	542	10	1.8	972	171	18.7

C=Cases; D=Deaths; CFR=Case fatality rate.

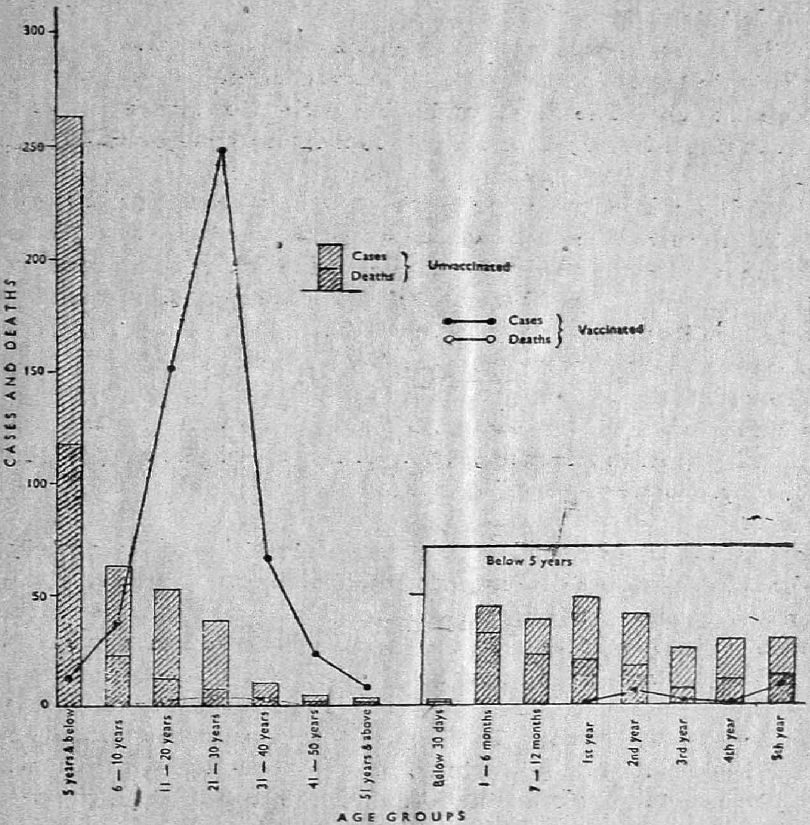

Fig. 3—Showing Distribution of Cases (Attacks and Deaths) in Different Age Groups and Vaccination Status. Inset Shows Corresponding Figures in Infants and Children (Up to 5 Years).

Haemorrhagic Smallpox

Haemorrhagic cases are of two types :

(a) Variola purpurica or true haemorrhagic smallpox or blackpox is a highly toxic variety with extensive haemorrhages into the skin and the mucous membranes and ending in death in the majority of cases even before the appearance of the focal rash.

In this series out of 1,000 cases 13 were of this variety. Of the latter, 8 occurred in the unvaccinated and 5 in the vaccinated groups (compare the proportion in the confluent type, 3: 1). The case incidence was 1·8 per cent in the unvaccinated as against 0·9 per cent in the vaccinated.

With reference to age there was no case under 10 years both in the vaccinated and the unvaccinated. 6 out of 8 cases in the unvaccinated and 4 out of 5 in the vaccinated occurred in age-group 21 to 50 which appears to be the most vulnerable age for this fatal variety of smallpox. With reference to sex, 7 out of 13 cases were females, 4 in the unvaccinated and 3 in the vaccinated. As regards the incidence with reference to the number of vaccination scars, 3 out of the 5 cases in the vaccinated was in the 4-scar group. All cases of this variety ended fatally.

(b) Variola pustulosa haemorrhagica is another variety of haemorrhagic smallpox where haemorrhages occur rather late in the course of the disease after the focal eruption has reached the stage of vesicle. There were 15 cases of this variety, of which 10 were in the unvaccinated with an incidence rate of 2·3 per cent as against 5 in the vaccinated with the incidence rate of 0·9 per cent. The majority of these cases also (11 out of 15) occured only in adults, though there were a few within 10 years in the unvaccinated. In the vaccinatdd, there was none below 10 years of age and 3 out of the 5 occurred only in the age-group of 21 to 30.

The incidence of this variety was greater in females than in males, with 3 out of 5 in the vaccinated and 6 out of 10 in the unvaccinated being females.

The case fatality rate was 90 per cent in the unvaccinated and 60 per cent in the vaccinated. The death rate was greater in females than in males, the figures being 89 per cent and 67 percent respectively. Table 9 shows the cases, deaths of haemorrhagic smallpox with reference to age, sex and vaccination status.

Table 7—Showing Number of Cases, Deaths and CFR with Reference to Type of Rash and Vaccination Status

Type of rash	Unvaccinated			Vaccinated			Total		
	C No.	D No.	CFR %	C No.	D No.	CFR %	C No.	D No.	CFR %
Modified ...	1	—	—	71	—	—	72	—	—
Discrete ...	143	13	9.0	380	1	0.26	523	14	2.6
Confluent ...	286	148	51.7	91	9	9.9	377	157	41.6
Totals ...	430	161	37.4	542	10	1 8	972	171	18.8

C = Cases; D = Deaths; CFR = Case fatality rate.

Table 8—Showing Number of Cases, Deaths and CFR among the Vaccinated with Reference to Type of Rash and Number of Vaccination Scars

Type of rash	1 scar			2 scars			3 scars			4 scars			Total		
	C No.	D No.	CFR %	C No.	D No.	CFR %	C No	D No.	CFR %	C No.	D No.	CFR %	C No.	D No.	CFR %
Modified ..	8	—	—	27	—	—	7	—	—	29	—	—	71	—	—
Discrete ...	46	—	—	113	—	—	39	1	2.5	182	—	—	380	1	2.256
Confluent ...	7	—	—	44	7	16	5	—	—	35	2	5.6	91	9	9.9
Totals ...	61	—	—	184	7	3.7	51	1	2.0	216	2	0.8	532	10	1.8

C = Cases; D = Deaths; CFR = Case fatality rate.

Table 9—Showing the Number of Cases of Haemorrhagic Smallpox and Deaths with Reference to Age, Sex and Vaccination Status

Age group (years)	Sex	Unvaccinated						Vaccinated						Total						Total	
		V.P.		V.P.H.		Total		V.P.		V.P.H		Total		V.P.		V.P.H.		Total		M	F
		C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D		
0—5	M	—	—	1	1	1	1	—	—	—	—	—	—	—	—	1	1	1	1	3	3
...	F	—	—	2	2	2	2	—	—	—	—	—	—	—	—	2	2	2	2		
6—10	M	1	1	—	—	1	1	—	—	—	—	—	—	1	1	—	—	1	1	2	2
...	F	—	—	1	1	1	1	—	—	—	—	—	—	—	—	1	1	1	1		
11—20	M	1	1	1	1	2	2	—	—	—	—	—	—	1	1	1	1	2	2	5	5
...	F	—	—	1	1	1	1	1	1	1	1	2	2	1	1	2	2	3	3		

21—30 ...	M	2	2	1	—	3	2	2	2	1	—	3	2	4	4	2	—	6	4	13	10
	F	3	3	1	1	4	4	1	1	2	1	3	2	4	4	3	2	7	6		
31—40 ...	M	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3
	F	1	1	1	1	2	2	1	1	—	—	1	1	2	2	1	1	3	3		
41—50 ...	M	—	—	1	1	1	1	—	—	—	—	—	—	—	—	1	1	1	1	1	1
	F	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
51 and above	M	—	—	—	—	—	—	—	—	1	1	1	1	—	—	1	1	1	1	1	1
	F	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Totals ...	M	4	4	4	3	8	7	2	2	2	1	4	3	6	6	6	4	12	10	28	25
	F	4	4	6	6	10	10	3	3	3	2	6	5	7	7	9	8	16	15		
G. Total ...		8	8	10	9	18	17	5	5	5	3	10	8	13	13	15	12	28	25		

V.P. = Variola purpurica; V.P.H. = Variola pustulosa haemorrhagica;
C = Cases; D = Deaths; M = Males; F = Females.

Discussion

The records of the incidence of smallpox during the last 50 years show that Madras city has become almost an endemic area for the disease, with periodic epidemics occurring roughly once in 4 to 6 years.

Though prevalent throughout the year the incidence was found to be maximum during February to April and minimum during June to November with a small rise in between during July and August. But, the year 1959 showed a deviation from the normal trend when the peak was reached in August and September. The relationship of meteorological conditions with seasonal variations in the incidence of smallpox was suggested. Whether the deviation of 1959 has any bearing on the meteorological conditions needs further study.

Cases of smallpox admitted to the Infectious Diseases Hospital, Madras from various parts of the city between May 1st to October 20th, 1959, numbering 1,000 were studied and findings presented in this paper. The study was undertaken about the incidence and distribution of smallpox with reference to age, sex, type of rash and vaccination status. The following are the salient features of the study.

Of the 1,000 cases studied, 28 belonged to the haemorrhagic type, which were excluded from the general analysis and dealt with as a separate entity, because they were almost in all respects different from the non-haemorrhagic variety. The remaining 972 were analysed.

For the purposes of this paper, the vaccinated showed the scars of vaccination. In the unvaccinated scars were not visible The last group included cases who were vaccinated for the first time during the incubation period of the attack.

In general, 55.7 per cent (542) of the total were vaccinated. Thus the incidence was a little higher in the vaccinated than in the unvaccinated. This paradoxical finding, is due to the fact that in the general population the vaccinated persons are far

larger in numbers than the unvaccinated. Hence the specific case incidence rate for the vaccinated would be less although numerically it may appear higher. But, if the incidence in children of 0-5 years age-group is compared, it is found to be significantly less in the vaccinated, which is not even one-twentieth of that in the unvaccinated. Even in the next higher age-group (6 to 10) the incidence in the vaccinated is comparatively less but the same thing cannot be said when the child is over 10 years old.

Secondly, the proportionate incidence of confluent attacks. is nearly 4 times higher in the unvaccinated than in the vaccinated. The incidence of confluent attaks was 65 per cent in the unvaccinated as against 12·5 percent in the vaccinated in children below the age of ten.

Thirdly, if the case fatality is taken into consideration, there is again significant reduction amongest the vaccinated, the case fatality rate being 1·8 per cent as against 37·4 per cent in the unvaccinated. Below 10 years of age, there was no death at all in the vaccinated as against the 42·9 per cent case fatality rate of in the unvaccinated.

All these clearly show that vaccination does not only reduce the incidence of smallpox but also the severity of the attack and it almost completely protects the subject from death from smallpox. Further, vaccination done in infancy protects an individual to a very great extent, even without revaccination, from smallpox up to the age of 10 years.

As regards the number of vaccination scars there appears to be a significant difference between cases of 1 and 2 scars and those of 3 and 4 scars. The proportionate incidence of confluent attacks in these groups were 20.8 per cent and 13.8 per cent respectively. Similarly the case fatality rate for these groups were 3.5 per cent and 1 per cent. From all aspects therefore 4 vaccination insertions appear to confer the greatest protection compared to a lesser number of insertions.

1.3 per cent of the total of 1,000 cases belonged to that variety of haemorrhagic smallpox known as variola purpurica. Of these, 61 per cent were unvaccinated. 1 8 per cent of the total unvaccinated and 0.9 per cent of the total vaccinated belonged to this fatal variety. Under the age of 10 years, there was no case of this variety. 60 per cent of the total cases of this variety in the vaccinated were amongst the 4-scar group. The fact that there was no case of this variety in children under 10 years even amongst the unvaccinated and there were more cases in the 4-scar group even amongst the vaccinated suggested that it was not the want of immunity alone that was responsible for the incidence of this variety of smallpox, but there might be some other factors peculiar to the agegroup of 21 to 40 which appeared to be the most vulnerable age-group for this type of attack. All these cases were 100 per cent fatal.

The other variety, variola pustulosa haemorrhagica, was a little more prevalent than the first variety. The incidence was 2·3 per cent in the unvaccinated and 0·5 per cent in the vaccinated. Though the majority of these cases (11 out of 15) occurred in adults yet it was not completely absent in children The incidence was higher in females than in males in the proportion of 3: 2. Even against this varity, vaccination does not seem to confer much immunity since as in the case of variola purpurica the incidence of this variety compared to the confluent was far less in unvaccinated children.

Apart from various aspects of incidence discussed one important conclusion of great significance was that the immunity which is supposed to be transmitted from the mother to the offspring through the placenta and which is supposed to last for a period of 6 months from birth is negligible and cannot be relied upon. In this sries, nearly 13 per cent of the total unvaccinated occurred in the age-group 1 month to 6 months

showing thereby that this congenital immunity may not last more than a month. Further, the impression that infants under the age of 6 months will not have the mechanism to prepare antibodies when active immunisation is done also appears to be wrong. In one of the maternity homes run by the Madras Corporation, the senior author is conducting a pilot investigation where about 700 newborn babies were vaccinated on the 3rd day after birth. From a preliminary check-up nearly 60 per cent of the babies were found to have developed primary take. This shows that a very negligible amount of immunity was transmitted through the placenta and also proves that even a newborn baby has the mechanism for the preparation of antibodies. This is confirmed by Seal *et al* (1959) who showed that vaccination could be done with a high degree of success if it is done under the age of one month. Similarly, 52 per cent of the vaccinations done on the 5th day after birth at primary centre hospitals in West Bengal were reported to be successful (Das Gupta, 1959).

ummary and Conclusion

A study of 1,000 cases of smallpox treated by the authors in the Infectious Diseases Hospital, Madras, is presented.

Judging by the incidence, severity of the rash and the case fatality this study revealed that vaccination in infancy afforded the greatest protection up to the age of 5 years against all the three, and beyond 5 years it afforded protection against the severity of attack and death. Amongst the vaccinated from all respects the 4-scar group fared better than those with lesser number of scars.

Vaccination did not appear to offer much protection against the haemorrhagic varieties. It appears that there might be some other factors than the want of immunity alone, responsible for the occurrence of this variety. This requires further investigation.

The so-called placental immunity does not appear to last more than a month after birth, and hence primary vaccination should be done as early in life as possible—at about the age of 1 month. The immunity conferred by 4 successful insertions in infancy appeared to last up to the age of 5 years beyond which it may wane off gradually unless the person is revaccinated periodically.

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